~~membrane electrolyte separating said chambers; and~~

a thermally sensitive actuator for controlling a flow of a fluid to/from the fuel cell.

38. The fuel cell according to claim 37, wherein said flow comprises a flow fuel or a flow of water.

39. The fuel cell according to claim 37, wherein the anode chamber is in fluid communication with a fuel source and wherein said flow comprises a flow of fuel or a fuel mixture to the anode chamber.

40. The fuel cell according to claim 39, wherein said fuel source communicates with said anode chamber via a conduit.

41. The fuel cell according to claim 40, wherein said thermally-sensitive actuator is proximate said conduit.

42. The fuel cell according to claim 40, wherein a temperature of said conduit reflects an operational temperature of said fuel cell.

43. The fuel cell according to claim 37, wherein said thermally-sensitive actuator comprises a bi-metal material and/or a shape-memory alloy.

44. The fuel cell according to claim 43, wherein said shape memory alloy comprises nickel and/or titanium.

45. The fuel cell according to claim 40, wherein said conduit includes a deformable

~~material.~~

46. The fuel cell according to claim 39, wherein said fuel source is selected from the group consisting of: a fuel cartridge, a pump, and a mixing chamber.

47. The fuel cell according to claim 45, wherein said actuator is positioned adjacent said deformable material.

48. A method for controlling flow in a fuel cell, comprising:

producing electrical energy in the fuel cell; and

actuating a thermally-sensitive actuator based on a temperature of the fuel cell for controlling a flow.

49. The method according to claim 48, wherein said thermally-sensitive actuator increases or decreases said flow.

50. The method according to claim 48, wherein said flow comprises a flow of fuel to the fuel cell or a flow of water to the fuel cell.

51. The method according to claim 48, wherein said actuator comprises a shape memory material, alloy and/or a bimetal material.

52. The method according to claim 51, wherein said bimetal material comprises a nickel and/or titanium alloy.

53. The method according to claim 48, wherein said thermally-sensitive actuator is

~~actuated in response to heat generated by the fuel cell.~~

54. A fuel cell comprising:

a housing including an anode chamber having a fuel mixture, said anode chamber in communication with a flow for adjusting the concentration of said fuel mixture, a cathode chamber, a protonically conductive, substantially electronically non-conductive membrane electrolyte separating said chambers; and

a fuel concentration-actuated valve for controlling said fluid flow.

55. The fuel cell according to claim 54, wherein said flow comprises a fuel flow or a water flow.

56. The fuel cell system according to claim 54, wherein said fuel mixture includes methanol.

57. The fuel cell according to claim 54, wherein said fuel concentration-actuated valve comprises a first material which expands in direct relation to fuel concentration.

58. The fuel cell according to claim 57, wherein said first material comprises Nafion.

59. The fuel cell according to claim 57, wherein said first material is positioned proximate a flow channel providing said fluid flow.

~~60. A method for controlling a flow in a fuel cell, comprising~~

producing electrical energy in said fuel cell;

providing a flow of a fluid to a fuel mixture of said fuel cell in response to said production of electrical energy; and

expanding a first material in response to a fuel concentration of said fuel mixture, wherein expansion of said first material controls said flow.

61. The method according to claim 60, wherein said flow comprises a flow of water or a flow of fuel.

62. The method according to claim 60, wherein said first material comprises Nafion.

63. The method according to claim 60, wherein said expansion of said first material increases or decreases said flow.

64. A sensor for determining a concentration of fuel in a fuel mixture for a fuel cell comprising a conductor disposed on or within a first material, wherein said first material expands in proportion to the concentration of fuel based on exposure to a fluid.

65. A sensor for determining the presence of a fuel in a fuel cell comprising a conductor disposed on or within a first material, wherein said first material expands in proportion to the concentration of fuel based on exposure to a fluid.

~~66. The sensor according to claims 64 or 65, wherein said fluid is water, methanol or a methanol/water mixture.~~

67. A method for determining a concentration of fuel in a fuel cell comprising:

providing a dimensionally variable first material capable of expansion and contraction in relation to a concentration of fuel in a fuel cell, wherein a conductor is disposed on or within the first material;

flowing an electrical current through said conductor;

measuring an electrical property of said conductor, wherein as fuel concentration changes, the first material expands resulting in a proportionate change to the electrical property of said conductor.

68. The method according to claim 67, wherein the electrical property comprises at least one of resistance, impedance, and conductance.

69. A direct methanol fuel cell system comprising:

an anode chamber having an anode and a diffusion layer, wherein a fuel is introduced to the anode chamber via the diffusion layer;

a fuel source in fluid communication with said anode chamber;

a cathode chamber having a cathode and a diffusion layer, wherein said diffusion layer is in fluid communication with an oxidizer; and

a protonically conductive, substantially, electronically non-conductive

~~membrane electrolyte separating said chambers and positioned substantially~~ adjacent to said diffusion layers; and

a first valve for controlling a flow of a fluid in response to an operating parameter of the fuel cell system.;

70. The system according to claim 69, where said valve comprises a thermally-sensitive actuator.

71. The system according to claim 70, wherein said thermally-sensitive actuator comprises a shape memory material or alloy.

72. The system according to claim 69, wherein said operating parameter comprises temperature and/or fuel concentration.

73. The system according to claim 69, wherein said valve comprises a first material capable of expansion proportional to a change in fuel concentration.

74. The system according to claim 73, wherein the first material comprises Nafion.

75. A switch for a fuel cell, said fuel cell comprising a housing including an anode chamber, a cathode chamber, a protonically conductive, substantially electronically non-conductive, membrane electrolyte separating said chambers, said switch comprising:

a thermally-sensitive material wherein below a predetermined temperature, said switch is in a first position, and upon said fuel cell reaching said predetermined temperature said switch is switched to a

~~second position.~~

76. The switch according to claim 75, wherein said thermally sensitive material comprises a shape memory alloy.

77. The switch according to claim 76, wherein said thermally-actuated shape memory alloy comprises nickel and/or titanium.

78. The switch according to claim 75, wherein said switch is disposed proximate to a portion of said fuel cell which reflects a current operational temperature of said fuel cell.

79. The switch according to claim 75, wherein a positioning of said switch between said first position and said second position is variable depending upon an operating temperature of said fuel cell.

80. A switch for a fuel cell, said fuel cell comprising a housing including an anode chamber, a cathode chamber, a protonically conductive, substantially electronically non-conductive, membrane electrolyte separating said chambers, said switch comprising:

a first material having expansion properties upon exposure to a fluid, wherein said switch is in a first position prior to exposure to said fluid and said switch is in a second position after said first material is exposed to said fluid.

81. The switch according to claim 80, wherein a positioning of said switch between

said first position and said second position is variable in a non-linear aspect in relation to an amount of said fluid said first material is exposed to.

82. The switch according to claim 80, wherein said switch is placed in a third position upon exposure of said first material to a concentration of a second fluid.

83. The switch according to claim 80, wherein the fluid comprises water or methanol.

84. The switch according to claim 80, wherein an actual position of said third position is directly dependent upon said concentration of methanol.

85. A thermally sensitive actuator for controlling a flow of a fluid to/from the fuel cell comprising a bi-metal material and/or a shape-memory alloy.

86. The actuator according to claim 85, wherein said shape memory alloy comprises nickel and/or titanium.

87. A fuel concentration-actuated valve for controlling a fluid flow in a fuel cell comprising a first material which expands in direct relation to fuel concentration.

88. The fuel concentration-actuated value according to claim 87, wherein the first material comprises Nafion.